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Ethanol – Gel Fueled Appliances

DRAFT STANDARD FOR PUBLIC COMMENTS

ZAMBIA BUREAU OF STANDARD

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This Draft Zambian Standard was prepared by the Renewable Energy Technical Committee, (TC 4/20), upon which the following organizations were represented:

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FOREWORD

The Zambia Bureau of Standards (ZABS) is the Statutory Organization established by an Act of Parliament. ZABS is responsible for the preparation of national standards through its various Technical committees composed of representation from government departments, the industry, academia, regulators, consumer associations and non-governmental organizations.

This Draft Zambian Standard has been prepared with assistance drawn from: SANS 666:2008 “*Ethanol-gel fueled appliances*”, published by South African National Standard (SANS) and in accordance with the procedures of ZABS. All users should ensure that they have the latest edition of this publication as standards are revised from time to time.

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ZAMBIA BUREAU OF STANDARDS

Draft Zambian Standard

Ethanol – Gel Fueled Appliances

1.0 SCOPE

This Draft Zambian Standard covers the requirements for ethanol-gel fueled appliances for cooking, heating and any other gel burning appliances. .

2.0 NORMATIVE REFERENCES

The under listed documents contain provisions which, through reference in this text, constitute provisions of this standard. All documents are subject to revision and, since any reference to a document is deemed to be the latest reference to the latest edition of that document, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the documents indicated below. Information on currently valid national and international standards may be obtained from the Zambia Bureau of Standards:

DZS 1238 Ethanol gel used for cooking and other gel burning appliances.

3.0 TERMINOLOGY

For the purpose of this Standard, the following terms and definitions shall apply.

- 3.1. **Acceptable:** acceptable to the authority administering this standard, or to the parties concluding the purchase contract, as relevant.
- 3.2. **Appliance:** ethanol-gel fueled device used for cooking or heating.
- 3.3. **Ethanol gel:** ethanol gel mixture meeting the minimum requirements of DZS 1238.
- 3.4. **Roll boiling:** condition when boiling at which vigorous convection is attained.

4.0 REQUIREMENTS

4.1. Materials

4.1.1. General

Material used in the construction of an appliance and its components shall be of such quality and thickness as to withstand (without cracking, warping, buckling, or other permanent damage) the operating conditions to which it will be subjected in normal service (see also 4.3.7 and 4.3.11).

4.1.2. Corrosion resistance

All metallic material shall be intrinsically corrosion-resistant, or be protected with an acceptable coating of such quality that, when tested in accordance with 6.11, there shall be no sign of pitting or penetration of the metal.

4.2. Construction

If not fully assembled, the appliance shall be assembled according to the manufacturer's instructions as supplied. Removable components shall fit in a positive, unique and rigid manner. No parts shall become detached if the appliance is knocked over. Permanently fitted components shall be rigid and fixed in a manner suitable for the duty they have to perform. If the design of the appliance is such that special tools are required for removable parts, such tools shall be supplied with the appliance.

4.3. Performance

4.3.1. Filling

The appliance shall be designed in such a way that it can be readily filled with minimum risk of spillage. Where necessary, the appliance shall be supplied with a tool/component that will facilitate the filling process (i.e. funnel, etc.). It shall not be possible to refill the appliance while it is alight.

4.3.2. Ignition

When the appliance is fully assembled and filled, it shall be readily lit.

4.3.3. Combustion performance

When tested in accordance with A.3, the appliance shall heat 1 l of water from 25 °C to 90 °C in less than 20 min and shall boil water within 30 min.

4.3.4. Power output

When tested in accordance with A.4, the appliance shall produce a heat output of at least 1 kW.

4.3.5. Flame regulator

The appliance shall be fitted with a flame regulator, which shall be readily accessible and easily adjusted when the appliance is alight.

4.3.6. Emissions

When tested in accordance with A.5, the CO₂:CO ratio shall not exceed a volumetric ratio of 1:0.02.

4.3.7. Rigidity (ability to withstand heavy load)

When the appliance is tested in accordance with A.6, no component shall become permanently distorted, or broken and each component shall maintain its mating component in an operative manner.

4.3.8. Stability of the appliance

When tested in accordance with A.7, the appliance shall not topple over.

4.3.9. Shutting off the appliance

When tested in accordance with A.8, there shall be no flame visible when the flame regulator is returned to its "ON" position.

4.3.10. Surface temperature

When tested in accordance with A.9, the surface temperature of any part of the appliance that may need to be touched during its operation shall not exceed 42 °C.

4.3.11. Durability

When tested in accordance with A10, the appliance and all its components shall be free of damage and distortion and all parts shall maintain their mating component in an operative manner.

4.4. Finish

Appliances shall have an acceptable appearance and a neat finish, all exposed surfaces shall be easily cleanable; edges and corners shall be smooth.

4.5. Additional requirements for heaters

4.5.1. The burner of a heater shall be covered with a guard that will prevent.

- a) Any contact with the burner, and
- b) Any loose, heated components from becoming dislodged from the heater.

4.5.2. If the heater is intended to be portable, it shall be furnished with the carrying handle that is applied in a position that the user cannot burn his/her hand.

5.0 PACKAGING, MARKING, INSTRUCTIONS AND WARNINGS

5.1. Packing.

Each appliance shall be packed so as to prevent damage to the appliance and its components and fittings during normal transportation and handling and there shall be no fuel in the fuel container.

5.2. Marking

Each appliance shall carry the following information legibly and indelibly marked in an easily identifiable position directly on the body or on an acceptable nameplate or a heat-resistant sticker effectively attached to the body:

- a) the name or trademark of the manufacturer and the country of origin;
- b) the manufacturer's model name and type number;
- c) the manufacturer's batch number; and
- d) the words "USE ETHANOL GEL ONLY".

5.3. Instructions and warnings

The manufacturer of the appliance shall supply written instructions and warnings accompanying the appliance concerning its assembly, safe use, maintenance and operation. This shall be written at least in English and have sufficient pictograms to ensure comprehension. The manufacturer's instruction shall include the following:

- a) Before lighting the appliance, ensure that all the components are undamaged and properly assembled in accordance with the illustrated design.
- b) Do not place the appliance near flammable items.
- c) Place the appliance on a reasonably level and stable surface. The level can be checked by placing a pan of water on the surface.
- d) Use only ethanol gel as a fuel.
- e) Do not use paraffin, petrol, methylated spirit or water in the appliance.
- f) Store ethanol gel out of reach of children in a safe container, marked "ETHANOL GEL".
- g) Use the appliance in a well ventilated area.
- h) Do not fill the appliance when lit.

- i) Do not carry or move a cooking appliance when lit.
- j) Do not leave a lit appliance unattended.
- k) Be extremely careful if it is necessary to move the lit appliance.
- l) Do not use the stove as a heater.
- m) Do not leave children alone when the appliance is lit.

NOTE 1: The manufacturer should include any other special instructions or warnings to ensure the safe and efficient operation of the appliance.

NOTE 2: The manufacturer should include instructions for the maintenance and servicing of the appliance to ensure optimum operation.

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ANNEX A (Informative) INSPECTION AND TEST METHODS

A1. Test room conditions and preparation of the appliance

A.1.1. Test room conditions

The appliance shall be tested in a well ventilated test room that shall be free of draughts likely to affect the performance of the appliance. The room temperature shall be $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

A.1.2. Preparation of the appliance

A.1.2.1. Both the appliance and the fuel shall be at room temperature at the start of the tests.

A.1.2.2. The appliance shall be placed on a reasonably level surface, in the case of a stove, a pot shall be put on the cooking surface.

A2. Inspection

Visually inspect each appliance for compliance with all the relevant requirements of clauses 4 and 5, compliance with which is not assessed by the tests given in 6.3 to 6.11 (inclusive). Also check and examine each appliance to ensure that all components are undamaged and are properly assembled and positioned according to the manufacturer's instructions.

A3. Combustion performance test

A.3.1. Apparatus

A.3.1.1. **Stove**, that is designed to operate on ethanol gel.

A.3.1.2. **Aluminium pot**, $225\text{ mm} \pm 5\text{ mm}$ in diameter and $125\text{ mm} \pm 5\text{ mm}$ in depth.

A.3.1.3. **Stopwatch**.

A.3.1.4. **Thermocouple**, that is able to measure temperature up to $100\text{ }^{\circ}\text{C}$.

A.3.2. Procedure

A.3.2.1. Ensure that the ambient air temperature of the laboratory is maintained at $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

A.3.2.2. Introduce 1 L of water into the pot.

A.3.2.3. Fill the stove to its maximum extent with ethanol gel.

A.3.2.4. Ignite the burner and adjust the flame to the highest level without any significant yellow appearance.

A.3.2.5. After ignition, place the pot on the cooking surface and immediately start the stopwatch.

A.3.2.6. Record the temperature rise of water every 5 min until it reaches $90\text{ }^{\circ}\text{C}$.

A.3.2.7. As soon as the water attains $90\text{ }^{\circ}\text{C}$, stop the stopwatch.

A.3.2.8. Continue heating water until roll boiling is achieved.

A.3.2.9. Record the total time taken to heat water from 25 °C to 90 °C. Check for compliance with 4.3.3.

A4. Determination of power output

- A.4.1. Fill the appliance to the maximum level with fuel. Determine the mass of the fuel and appliance to ± 1 g. If the appliance is designed as a cooker, place a pot containing 2 L of water on the appliance.
- A.4.2. Ignite the appliance and note the time.
- A.4.3. Adjust the flame to the highest level without any significant yellow appearance.
- A.4.4. Allow the appliance to burn for 30 min without refuelling while adjusting the flame, if needed, to its highest level without any significant yellow appearance.
- A.4.5. After 30 min, extinguish the appliance and remove the pot.
- A.4.6. Once more, determine the mass of the appliance to ± 1 g.
- A.4.7. Calculate the power output in kW as follows:

$$PO = (M_i - M_e) \times \frac{16}{18000}$$

Where

PO is the power output in kW;

M_i is the mass of the appliance before igniting, in grams;

M_e is the mass of the appliance after burning for 30 min, in grams.

A.4.8. Check for compliance with 4.3.4.

A5. Emissions test

A.5.1. Apparatus

- A.5.1.1. **Aluminium pot**, 225 mm \pm 5 mm in diameter and 125 mm \pm 5 mm in depth.
- A.5.1.2. **Collecting hood**, as illustrated in figure 1 in the case of a stove.
- A.5.1.3. **Collecting hood**, as illustrated in figure 2 in the case of a heater.
- A.5.1.4. **Gas measuring instrument**, that can determine the quantity of carbon monoxide and carbon dioxide developed inside the collecting hood while the appliance is in operation.

A.5.2. Procedure

- A.5.2.1. Fill and light the appliance and adjust the flame to the highest level without any significant yellow appearance.
- A.5.2.2. For the stove, place the pot filled with water on the cooking surface and place the collecting hood over the stove such that the hood fits securely on the pot and the steam that develops is conveyed by means of the vents. Let the appliance run for 10 min before taking the samples.
- A.5.2.3. For the heater, place the collecting hood over the lit appliance. Let the appliance run for 10 min before taking the samples.
- A.5.2.4. Using a suitable measuring instrument, collect sufficient samples of gas and determine the CO₂:CO ratio and check for compliance with 4.3.6.

A6. Rigidity test

A.6.1. Apparatus

20 kg masspiece, of diameter 250 mm \pm 3 mm.

A.6.2. Procedure

- A.6.2.1. At the conclusion of the determination of the power output test (see 6.4) refill and light the appliances.
- A.6.2.2. Place the masspiece on top of each cooking surface for a period of 8 h, refilling and relighting the appliance as necessary.
- A.6.2.3. Carefully remove the masspiece, and inspect the appliance and components for compliance with 4.3.7.

A7. Stability test

A.7.1. Apparatus

Aluminium pot, 225 mm \pm 5 mm in diameter and 125 mm \pm 5 mm in depth filled with 3 L of water.

A.7.2. Procedure

A.7.2.1. When the appliance is full

Fill the appliance to its maximum extent. Tilt the appliance through an angle of 10°, maintain that position for 3 min, and check for compliance with 4.3.8. Repeat the test in three other directions, each 90° from the preceding one.

A.7.2.2. When the appliance is empty

Empty the appliance of all fuel. Place the pot on the appliance. Tilt the appliance through an angle of 10° and check for compliance with 4.3.8. Repeat the test in three other directions, each 90° from the preceding one.

A8. Shutting off the appliance test

A.8.1. Apparatus

A.8.1.1. **Aluminium pot**, 225 mm \pm 5 mm in diameter and 125 mm \pm 5 mm in depth.

A.8.1.2. **Stopwatch.**

A.8.2. Procedure

- A.8.2.1. Fill the fuel tank to its maximum extent.
- A.8.2.2. Light the burner(s) and adjust the flame to the highest level without any significant yellow appearance. Place the pot filled with 2 L of water on the cooking surface of the appliance. Let the appliance burn for 1 h.
- A.8.2.3. Turn the flame regulator to the “OFF” position and simultaneously start a stopwatch.
- A.8.2.4. 5 s later, turn the flame regulator to the “ON” position and check that the flame has been extinguished.
- A.8.2.5. Check for compliance with 4.3.9.

A9. Surface temperature

A.9.1. Apparatus

A.9.1.1. **Aluminium pot**, 225 mm \pm 5 mm in diameter and 125 mm \pm 5 mm in depth.

A.9.1.2. **Thermocouple**.

A.9.2. Procedure

A.9.2.1. Fill the appliance to its maximum extent.

A.9.2.2. Place a pot filled with 2 L of water on each cooking surface. Light the burner(s) and run the appliance for 1 h.

A.9.2.3. Using a thermocouple, measure the surface temperature of the flame regulator and any other parts that may need to be touched during normal operation.

A.9.2.4. Check for compliance with 4.3.10.

A10. Durability test

Ignite the appliance and adjust the flame to its highest level without any significant yellow appearance. Allow the appliance to burn at this rate for 6 h, refilling and relighting the appliance as necessary. After this period, allow the appliance to cool to room temperature. Repeat this procedure 10 times. Leave the appliance to cool for 1 h, thereafter, inspect the appliance and its components for any damages.

Check for compliance with 4.3.11.

A11. Corrosion resistance test

A.11.1. Procedure

A.11.1.1. Remove any residue from the fuel container of the appliance with warm water, and dry it.

A.11.1.2. Examine the fuel container for any signs of damage or corrosion. Check for compliance with 4.1.2.

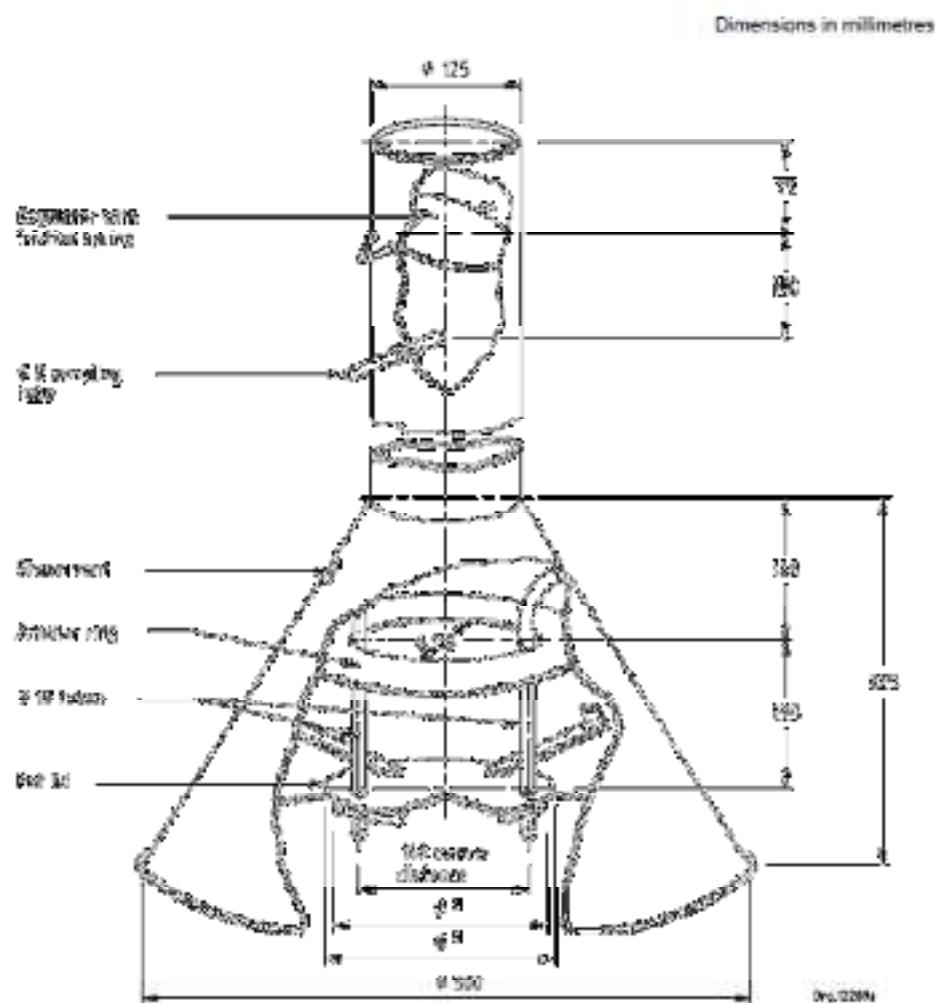
A.11.1.3. Fill the container with a gel fuel that complies with the requirements of SANS 448 according to the manufacturer's instructions.

A.11.1.4. Place the appliance in a fume cupboard or fume hood operated at an air velocity sufficient to remove the products of combustion for 10 min.

A.11.1.5. Ignite the fuel and allow it to burn completely, then leave the appliance in the fume cupboard until the next test.

A.11.1.6. Repeat 6.11.1.1 to 6.11.1.5 (inclusive) above every day for a total of 20 working days.

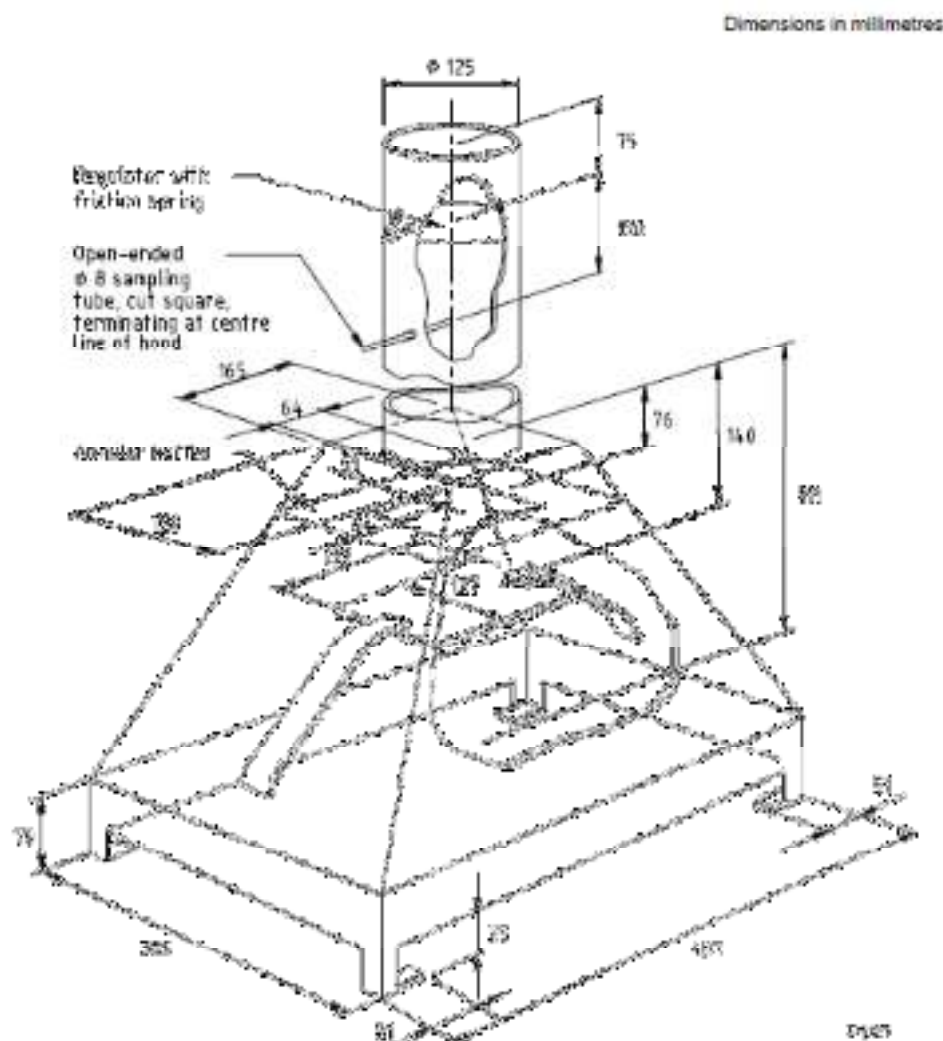
A.11.1.7. Check the appliance for compliance with 4.1.2.



* Diameters suitable to secure fitting to the pot as described in 6.9.1.

Figure 1 — Collecting hood for cooking stove

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